Technical Documentation

2238 Mediator
Integrating Sound Level Meter
Frequency Analysis Software BZ 7123

Brüel & Kjær

English BB 1128–11

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Introduction

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1.1 About this Manual

1.1.1 Summary of Contents

- **Chapter 1 – Introduction**: provides a general overview of the Frequency Analysis module, its functions and information about serial frequency analysis.
- **Chapter 2 – Key Functions**: provides information about the key functions for the Frequency Analysis module.
- **Chapter 3 – Measurements Set-up Menu**: gives instructions for setting up the measurement parameters for the Frequency Analysis module.
- **Chapter 4 – Measuring:** gives information about using the Broadband Measurement Window, the Working Spectrum Window and the Average Spectrum Window. Gives instructions for using the back erase function and for setting up an Auto Start.
- **Chapter 5 – Data Handling**: contains information about the parameters that are saved in the Frequency Analysis module, how to save, recall and delete data and how to switch between displays.
- **Chapter 6 – Specifications**: contains technical specifications for the Frequency Analysis module.
- **Appendix 1 – General:** lists the default parameters, the general messages and the error messages that are specific for the Frequency Analysis module.
- **Appendix 2 – Interface**: gives instructions for using the interface commands and queries for the Frequency Analysis module
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1.1.2 About this Volume

This volume of the User Manual deals only with the instructions and functionality that are specific for the Frequency Analysis module (Frequency Analysis Software BZ 7123).

For information about the general operation and functionality of Mediator please refer to the Basic User Manual (BB 1119).

Conventions Used in this Manual

Keys

References to keys on the 2238 Mediator are shown with the key's pictogram as it appears on the instrument (for example ±/+). Refer to section 2.1 for a complete list of key pictograms and their functions.

Soft Keys

Mediator has two "soft keys" that have different functions depending on the current context. The soft keys functions are denoted by chevrons (<>) and courier type face. The current functions of the soft keys are always shown on the display. The ▭ soft key can have the following functions: `<Select>`, `<Save>`, `<Ok>`, `<Menu>` or `<Back Erase>`. The ▭ soft key can have functions: `<Cancel>`, `<Undo>` or `<Close>`. This is similar to the functionality from the familiar Windows® environment.

Parameter Text

Text which refers directly to text on the instrument's screen or printouts is indicated using a `Courier` type face.

For example: Press ▼ until `Language` is highlighted in the System menu.

Sockets

Reference to sockets is made in bold type face (for example, **Aux 1**).

1.2 Serial Frequency Analysis

1.2.1 What is Serial Frequency Analysis?

A 2238 Mediator with a filter set installed can measure sound levels in nine $^1/_1$-octave bands (from 31.5 Hz to 8 kHz) or 29 $^1/_3$-octave bands (from 20 Hz to 12.5 kHz). A serial frequency analysis is a number of consecutive measurements performed in each of the selected frequency bands. The result is a spectrum measured over some time, the elapsed time or measurement time. During the same period a broadband measurement is performed, see Fig. 1.1.

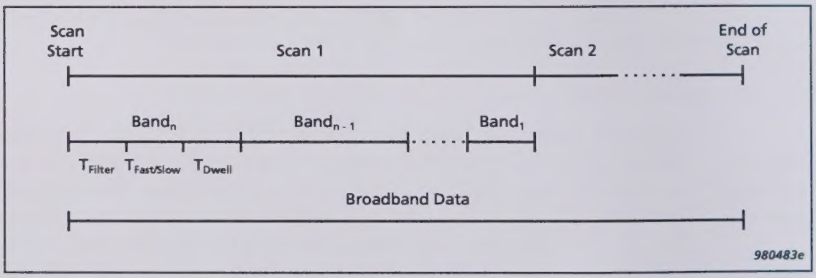

Fig. 1.1 *Time sequence for a measurement consisting of a number of scans. Each scan is a serial frequency analysis which consists of a number (n) of frequency bands. The measurement time required for each frequency band is the sum of the three time intervals: T_{Filter}, $T_{Fast/Slow}$ and T_{Dwell} (see below)*

When making a frequency analysis with Mediator running Frequency Analysis Software BZ 7123, the complete result of a measurement is a spectrum and overall broadband values for the measurement time.

Since a frequency analysis is done by measuring in each frequency band serially (contrary to measuring all bands in parallel), the method is most useful for fairly stationary signals, for example those emitted by rotating machinery. Highly

fluctuating signals, for example from fly-overs and concerts, cannot be measured reliably using serial analysis.

Furthermore, to get a reliable result for a random signal the measurement time in a frequency band depends upon the centre frequency of the band. At high frequencies only a short time is needed, at lower frequencies the measurement time increases. The time that is used for measuring in each band is referred to as dwell time (T_{Dwell}). For further information refer to Brüel & Kjær publication: "Frequency Analysis" (BT 0007).

1.2.2 Dwell Time

As stated above, the required measurement time varies for different frequencies. If the signal is non-stationary, for example fluctuating in a cyclical manner, even more measurement time may be required to average the fluctuations. Mediator with BZ 7123 offers three ways of controlling frequency analyses:

- Optimized dwell time with three levels of statistical error (or tolerance, see below)
- Fixed, user-selected dwell time
- Averaging of several spectra, with one averaged spectrum as the result

Optimized and fixed dwell times are explained below. Averaging of spectra is explained in section 3.1.5.

Optimized Dwell Time

Dwell times can be optimized in the sense that the reliability or tolerance in all measured frequency bands is the same. This is what Mediator does when you select Optimized dwell time. When `Optimized` is selected you can choose the required Tolerance (see section 3.1.5). The options are:

- 0.25 dB, 0.5 dB, and 1.0 dB

Choosing, for example, 0.5 dB tolerance means that there is 67% probability that the measurement results in all selected

bands are within 0.5 dB for a normally distributed random signal.

It is important to note that the required tolerance influences the total measurement time. For example, scanning all $^1/_3$-octave bands with 0.25 dB tolerance gives a total measurement time of 5 minutes and 50 s – changing the tolerance to 1.0 dB gives 55 s measurement time. Also note that most of the measurement time is spent at low frequencies. The required measurement time can be read directly from the display in the `Time Left` field in the Working Spectrum Window and the Broadband Measurement Window.

Fixed Dwell Time

As an alternative to Optimized dwell time, you can select a Fixed dwell time. In this case the same amount of time is used in all $^1/_1$- or $^1/_3$-octave bands. The dwell time can be set in the range from 1 second to 60 minutes (see section 3.1.5).

Using Fixed dwell time is most useful when measuring periodically fluctuating signals. All fluctuations in the signal must be covered during the measurement time.

Total Measurement Time

The time required to make a frequency analysis is not simply the sum of the dwell times (see Fig. 1.1). For each band to be measured, Mediator must switch on the required octave band filter and ensure that the filter and the detector are settled. The filter transient time is referred to as T_{Filter} and the time it takes to reset the Fast and Slow time constants is referred to as $T_{Fast/Slow}$. The total measurement time is the sum of dwell times and settling times, i.e., $T_{Dwell} + T_{Filter} + T_{Fast/Slow}$. These are shown in Table 1.1.

Freq. (Hz)	T_{Filter} (s)		$T_{Fast/Slow}$ (const.) (s)	T_{Dwell} (Optimized), (s)					
				0.25 dB		0.5 dB		1.0 dB	
	1/3-oct.	1/1-oct.		1/3-oct.	1/1-oct.	1/3-oct.	1/1-oct.	1/3-oct.	1/1-oct.
12500	0.5	–	Fast: 0.475 Slow: 3.8	0.25	–	0.25	–	0.25	–
10000	0.5	0.5		0.25	0.25	0.25	0.25	0.25	0.25
8000	0.5			0.25		0.25		0.25	
6250	0.5			0.25		0.25		0.25	
5000	0.5	0.5		0.26	0.25	0.25	0.25	0.25	0.25
4000	0.5			0.33		0.25		0.25	
3125	0.5			0.41		0.25		0.25	
2500	0.5	0.5		0.52	0.25	0.25	0.25	0.25	0.25
2000	0.5			0.65		0.25		0.25	
1600	0.5			0.82		0.25		0.25	
1250	0.5	0.5		1.04	0.43	0.26	0.25	0.25	0.25
1000	0.5			1.31		0.33		0.25	
800	0.5			1.64		0.41		0.25	
625	0.5	0.5		2.07	0.86	0.52	0.25	0.25	0.25
500	0.55			2.61		0.65		0.25	
400	0.5			3.28		0.82		0.25	
315	0.5	0.7		4.13	1.71	1.03	0.43	0.26	0.25
250	0.5			5.20		1.30		0.32	
200	0.5			6.55		1.64		0.41	

Table 1.1 Settling and dwell times used for calculating the total measurement time

Freq. (Hz)	T_{Filter} (s)		$T_{Fast/Slow}$ (const.) (s)	T_{Dwell} (Optimized), (s)					
				0.25 dB		0.5 dB		1.0 dB	
	1/3-oct.	1/1-oct.		1/3-oct.	1/1-oct.	1/3-oct.	1/1-oct.	1/3-oct.	1/1-oct.
160	0.5	0.7	Fast: 0.475 Slow: 3.8	8.24	3.42	2.06	0.86	0.52	0.25
125	0.5			10.37		2.59		0.65	
100	0.5			13.06		3.27		0.82	
80	0.5	0.7		16.44	6.79	4.11	1.70	1.03	0.42
62.5	0.63			20.70		5.18		1.29	
50	0.8			26.06		6.52		1.63	
40	1	0.7		32.81	13.58	8.20	3.39	2.05	0.85

Table 1.1 (cont.) Settling and dwell times used for calculating the total measurement time

1.3 Measurement Parameters

1.3.1 Spectrum Parameters

Table 1.2 lists the spectrum ($^1/_1$- or $^1/_3$-octave band) parameters available with the Frequency Analysis module. The Y suffix in the parameter names refers to time weightings (F or S).

Spectrum Parameters				
Parameter	**Default Screen Parameter**	**Definition**	**Freq. Weighting**	**Time Weighting**
L_{eq}	L1kHzeq	Equivalent continuous level for the current frequency band	–	–
L_{YMax}	L1kHzFMax	Max. L_{Yp} value detected within the current frequency band	–	"F" or "S"
L_{YMin}	L1kHzFMin	Min. L_{Yp} value detected within the current frequency band	–	"F" or "S"

Table 1.2 Spectrum parameters available with the Frequency Analysis module

1.3.2 Broadband Parameters

Table 1.3 lists the broadband parameters available with the Frequency Analysis module. These parameters can be displayed in the Broadband Measurement Window. The X and Y suffixes in the parameter names refer respectively to frequency weightings (A, C or L) and time weightings (F or S).

Broadband Parameters (Detector 2)				
Parameter	**Default screen parameter**	**Definition**	**Freq. Weighting**	**Time Weighting**
L_{Xeq}	LCeq	Equivalent continuous level for the duration of the measurement (all scans) as defined by IEC 1672	"A", "C" or "L"	–
L_{XYMax}	LCFMax	Max. L_{XYp} value detected within the elapsed time	"A", "C" or "L"	"F" or "S"
L_{XYMin}	LCFMin	Min. L_{XYp} value detected within the elapsed time	"A", "C" or "L"	"F" or "S"
Overload%	Overload%	The percentage of time that an overload occurred during a measurement	–	–
Underrange%	Under-range%	The percentage of time that an underrange occurred during a measurement	–	–
Instantaneous Parameters (Display Only)				
L_{XYInst}	LCFInst	Instantaneous value of RMS level	"A", "C" or "L"	"F", "S" and "I"
L_{XYp}	LCFp	Sound pressure level (SPL)	"A", "C" or "L"	"F", "S" and "I"

Table 1.3 Broadband parameters available with the Frequency Analysis module

1.3.3 General Parameters

Table 1.4 lists the general parameters available with the Frequency Analysis module.

General Parameters		
Parameter	**Default Screen Parameter**	**Definition**
Elapsed Time	`Elapsed Time`	The amount of time that has passed since the current measurement began (measurement time excluding pauses)
Start Time	`Start Time`	The start time for the current measurement
Start Date	`Start Date`	The start date for the current measurement
Time Left	`Time Left`	The amount of time that remains before the measurement is complete
Scan No.	`Scan No.`	Shows the current scan number and the total number of scans

Table 1.4 General parameters available with the Frequency Analysis module

1.4 Frequency Analysis Functions

1.4.1 Back-erase

The back-erase function allows you to delete any required number of consecutive frequency bands in a frequency analysis. This is particularly useful if a disrupting noise occurs during a measurement.

1.4.2 Aux 1

Aux 1 is set up as an AC Output and cannot be changed.

1.4.3 Aux 2

In addition to the DC Output function in the basic version, **Aux 2** can be set up as a trigger input or a trigger output.

1.4.4 Measurement Set-up Menu

The Measurement Set-up menu contains the following items in the Enhanced module:

- `Weightings` (for selecting $^1/_1$- or $^1/_3$-octave bands, for setting the frequency range and for setting broadband frequency weighting and time weighting)
- `Measurement Control` (for setting up number of scans, dwell time and Auto Save)
- `Correction Filters` (for selecting correction filters for sound incidence and windscreen)
- `Input/Output` (for selecting DC Output, Trigger Input or Trigger Output for the **Aux 2** sockets)
- `Auto Start` (for selecting an Auto Start)
- `Save Setup` (for saving a measurement set-up)
- `Recall Setup` (for recalling a measurement set-up)

Chapter 2

Key Functions

2.1 Key Functions ..... 2 – 2

2.1 Key Functions

Each key on Mediator's front panel is marked with a pictogram. This section gives a brief explanation of the keys.

Power	⏻	Press this to switch Mediator on or off. The instrument starts in pause mode.
Calibrate		Press this to calibrate Mediator.
System		Press this to display the System menu for configuring the instrument and for changing application programs.
Data Files		Press this to select the Data Files menu. The menu options in this window allow you to save and print files and to access the File Manager facility. **Frequency module:** If more than one measurement file is recalled, you can use to switch between the recalled files.
Set-up		Press this to access/step through the set-up options in the Measurement Set-up menu.
Up/Down Arrows ▲ ▼		Press these keys to step up/down in the menu items in the selected window. **Frequency module:** Use the keys to enter/exit edit mode in the Broadband Measurement Window and to select the parameter field in the Working and Averaged Spectrum Windows. You can also use these keys to switch between the Averaged Spec-

trum and Broadband Measurement Windows, when recalling measurements.

Left/Right Arrows ◄ ► Press these keys to select the parameters in the selected window.

Note: For the sake of consistency the ▲ ▼ keys are always used to select menu items, and the ◄ ► keys are always used to select values.
Frequency module: Use the ◄ ► keys to step the cursor through (left or right) the frequency bands in the Working and Averaged Spectrum Windows.

Range Press this to access the Range Setting menu. Use the ◄ ► keys to step through the available measurement ranges or scroll with the key.

Reset Resets the current measurement data. The Working and Average Spectra are also reset. If a measurement is in progress, it continues immediately after reset. If the instrument is paused, it is still paused after pressing Reset.
Note: If a measurement has been in progress for more than a minute a warning is displayed and you must confirm the command before any data is deleted.

Meas. Results Press this in any of the set-up menus to return to one of the Measurement Windows. If menu changes have not been saved, they are cancelled.

Frequency module: Use this key to switch between the Broadband Measurement Window and the Working and Average Spectrum Windows.

Pause/Continue — Press this to pause/continue the current measurement. When resuming a measurement after pausing Mediator, the measurement is continued without resetting data or the timer.
Frequency module: Pressing this key after a measurement is finished performs a reset and starts a new measurement.
Pressing it during a measurement, when the Working Spectrum Window is displayed, activates the Back Erase mode (see Select).

Select — Functions as <Select>, <Save>, <Recall> or <Ok> depending on the cursor position in the current menu. The <Menu> function displays the File Manager Options Window.
Frequency module: Functions as <Back Erase> key in the Working Spectrum Window, when the Back Erase mode is activated. Pressing the key deletes the frequency bands back to and including the band where the cursor is positioned.

Cancel — Functions as <Cancel>, <Undo> or <Close> depending on the cursor position in the current menu.

Backlight — Switches the display's backlight on or off. To save batteries, the back-

light switches off automatically after 30 seconds.

Chapter 3

Measurement Set-up Menu

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3.1 Measurement Set-up Menu

3.1.1 Introduction

This chapter explains how to set up measurement parameters that are specific for the Frequency Analysis module.

3.1.2 Measurement Set-up Menu

Frequency Analysis Software BZ 7123 contains the menu items shown in Fig. 3.1.

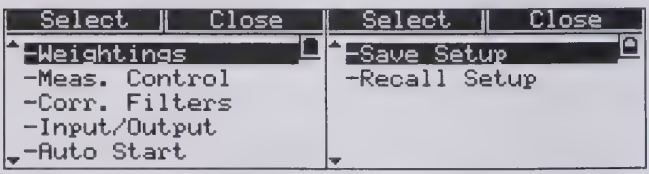

Fig. 3.1 The Measurement Set-up menu (two windows)

3.1.3 Range

There is no `General` Window in the Frequency Analysis module, this means that the Range Setting menu must be accessed by pressing the Range key.

3.1.4 Setting Frequency Weightings

The `Weightings` Window is used for setting up frequency and time weightings for octave and broadband data, see Fig. 3.2.

Note that $^1/_1$- and $^1/_3$-octaves are always measured with detector 1 and broadband data is measured with detector 2. Time weighting settings apply to both detectors.

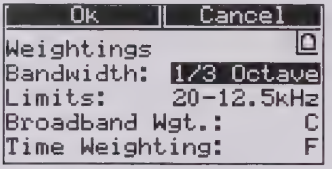

Fig.3.2 The Weightings Window

Setting Bandwidth

- 1/3-octave
- 1/1-octave

Select the desired option in the Bandwidth field.

Note: To run Frequency Analysis Software BZ 7123 the $^1/_1$-octave and $^1/_3$-octave Filter Set must be installed in Mediator.

Setting Frequency Limits for Octave Bands

For setting the frequency range for the frequency analysis. The Limits parameter field automatically changes to $^1/_1$- or $^1/_3$-octave frequency steps according to the Bandwidth field above. The default values are:

- 31.5 Hz – 8 kHz ($^1/_1$-octave)
- 20 Hz – 12.5 kHz ($^1/_3$-octave)

Use the ▲ ▼ cursor keys to select the lower or upper frequency fields and set the desired range with the ◄ ► cursor keys. If you change the Bandwidth setting, Mediator remembers the corresponding Limits setting.

Note: The lower frequency must always be lower than or equal to the upper limit. The upper or lower limits are automatically adjusted to fulfil this requirement. Setting the upper and lower limits to the same value is equivalent to selecting a single frequency band with that centre frequency.

Setting Frequency Weighting for Broadband Data

- A, C, L

In the Broadband Wgt. field you can select A, C or L frequency weighting. This frequency weighting only applies to the broadband data.

Setting the Time Weighting

- F, S

The Time Weighting field is used to set the time weighting used for both octave and broadband data. You can select the standardised F and S time weightings.

3.1.5 Measurement Control

The Meas. Control Window, see Fig. 3.3, is used to set up the parameters that affect the accuracy of a frequency analysis and whether a measurement is saved automatically or not.

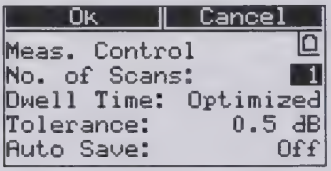

Fig. 3.3 The Measurement Control Window

Setting the Number of Scans

No. of Scans allows you to set up the desired number of frequency scans from 1 to 99. This is the number of averages that is used to display the result in the Average Spectrum Window. As a general rule frequency analysis should be performed on stationary signals. However, with appropriate averaging a good representation can be made for a number of non-stationary signals.

Setting the Dwell Time

Dwell Time is used for setting the measurement time for each frequency band (T_{Dwell}) in the frequency analysis.

- Optimized
- Fixed

When Optimized is selected Mediator automatically calculates the optimum measurement time (T_{Dwell}), based on the current frequency band and the specified measurement tolerance (see Tolerance below). Refer to section xx for information about filter characteristics and calculation of measurement time. For normal frequency analysis you should select Optimized.

Setting Tolerance/Time

Depending on whether Optimized or Fixed is selected in the Dwell Time parameter field, this parameter field appears as Tolerance or Time respectively.

Tolerance

- 0.25, 0.5, 1.0dB

Specifies the measurement tolerance when Optimized is selected. Lower tolerance (higher accuracy) increases the measurement time.

Fixed

- 00:01 ... 60:00

Fixed allows you to specify a measurement time (T_{Dwell}) which is always constant, irrespective of frequency band and octave bandwidth (see Time below).

Use the ▲ ▼ cursor keys to select the minute or second fields and set the desired time with the ◄ ► cursor keys. The Fixed time can be set from 1 second to 60 minutes.

Setting up Auto Save

- On
- Off

The Auto Save function can be switched on or off. When activated it will automatically save a measurement when it is finished, i.e. when the specified number of scans is com-

pleted. A measurement is not saved when the pause function is activated. Measurements are stored with consecutive numbers in the File List.

3.1.6 Setting up the Input/Output Function

The `Input/Output` Window controls the function of the **Aux 1** and **Aux 2** inputs/outputs. See Fig. 3.4.

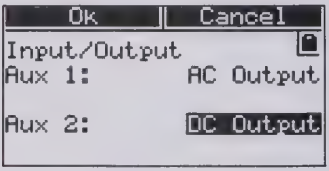

Fig. 3.4 The Input/Output Window

Aux 1

The `Aux 1` field is set to `AC Output` and cannot be accessed. The AC output signal is fed to the **Aux 1** socket. The AC output corresponds to the constant output from the scanned octave bands, with filter transients.

Full-scale indication corresponds to 1 V RMS. This output signal can be used, for example, for recording the measured signal on a DAT recorder.

Aux 2

- `DC Output`
- `Trigger Input`
- `Trigger Output`

`DC Output` supplies a DC output signal equivalent to the AC output signal. Full-scale indication corresponds to 4.0 V DC (50 mV/dB).

`Trigger Input` starts a measurement when an external trigger voltage is applied. The trigger level is 2 V (refer to

Specifications). A trigger is ignored if Mediator is not paused and displays one of the Measurement Windows.

`Trigger Output` supplies a status voltage that is high (>4 V DC) when a measurement is proceeding or low (0 V) when the instrument is paused. The Trigger Out signal can be used to start/stop external equipment such as tape and level recorders.

Chapter 4

Measuring

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4.1 Measurement Result Windows

Three different measurement result windows are used for the frequency analysis module: Working Spectrum Window, Averaged Spectrum Window and Broadband Measurement Window. The result windows are illustrated in Fig. 4.1. Use the Meas. Results key to change between the windows in the mentioned order.

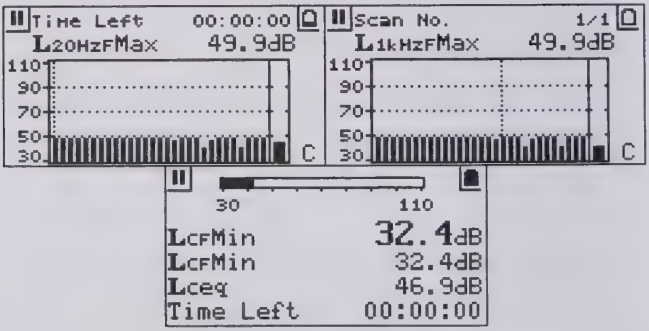

Fig. 4.1 The Working Spectrum Window, the Averaged Spectrum Window and the Broadband Measurement Window, shown in that order

4.1.1 Working and Averaged Spectrum Windows

The Frequency Analysis module has two spectrum displays. The Working Spectrum Window shows the results so far of the current scan of the frequency bands, i.e., it reflects the currently ongoing measurement. The Average Spectrum Window shows the cumulative results of the selected number of scans.

The result of a measurement is what is in the Averaged Spectrum. This spectrum is updated whenever a scan of the frequency bands is completed; if more than one scan is performed, each new complete scan is averaged with the current contents of the Averaged Spectrum. When only a single scan

is performed, the result of this scan is also transferred to the Averaged Spectrum.

Example: If you select five scans of the 29 $^1/_3$-octave bands and start the measurement, you will see the Working Spectrum being updated as the frequency bands are measured. The Averaged Spectrum has no content until the first scan of all 29 bands is completed. At that time it is updated with the results of the first scan and shows that this is result 1 out of 5 scans (`Scan No. 1/5`). When scan no. 2 starts, the Working Spectrum is cleared and shows the results of the second scan as the frequency bands are available. Next update of the Averaged Spectrum is when the second scan is complete, and so on until all five scans are completed. At this time the Averaged Spectrum shows the result of five averaged spectra, and the Working Spectrum shows the result of the last scan (scan no. 5). If the measurement is saved, automatically or manually, it is the Averaged Spectrum that is saved.

If you select, for example, 10 scans and choose to stop the measurement after three scans by pausing the measurement in the middle of the fourth scan, the Averaged Spectrum is the result of the three completed scans, i.e., you always save the result of completed scans and any half-finished scan (in this example the fourth scan) is not saved. The only exception is when the first scan is not finished. In this case it is possible to save the finished frequency bands (after a warning that the scan is incomplete). The saved frequency bands are also shown in the Averaged Spectrum. After saving an incomplete scan, the measurement can be continued.

Display Layout

The two spectrum windows are fairly similar. The upper parameter line (`Time Left`) in the Working Spectrum Window shows the total/remaining measurement time. In the Averaged Spectrum window this field is replaced with a `Scan No.` line which shows the current/total number of scans.

Note: Measurement times higher than 1000 hours are displayed as: `---:--:--` in the `Time Left` fields in the Broadband Measurement and Working Spectrum Windows.

The second parameter line in both windows show the current spectrum parameter and the frequency/measurement value which the cursor points at or which is being measured.

4.1.2 Broadband Measurement Window

The Broadband Measurement Window is similar to the Measurement Window in the Basic module. In the four parameter fields you can select between the parameters available in the Frequency Analysis module:

- L_{XYinst}, L_{XYp}, L_{Xeq}, L_{XYMax}, L_{XYMin}, Overload%, Underrange%, Time Left, Start Date, Start Time, Elapsed Time, Time, Scan No.

4.1.3 Selecting Spectrum Parameter for Display

During measurement or when a measurement is finished you can change the displayed spectrum parameter in the Working and Averaged Spectrum Windows. You can select the following spectrum parameters:

- L_{Xeq}, L_{XYMin} or L_{YMax}

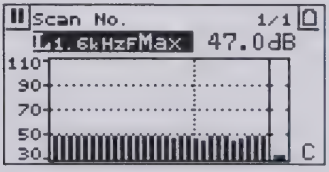

Fig. 4.2 The Spectrum Parameter field (highlighted)

1. Use the ▲ or ▼ keys to select the Spectrum Parameter field.

2. Use the ◄ ► keys to select the spectrum parameter. The display changes accordingly.

4.1.4 Using the Spectrum Cursor

When a measurement is finished you can use the ◄ ► keys to step the cursor through the measured frequency bands in the Working and Averaged Spectrum Windows. The frequency and associated measurement value can be seen in the parameter line.

4.1.5 Overloads

Instantaneous and latched overloads are displayed in the Broadband Measurement Window in the same way as in the Measurement Window in the Basic module.

In the Working and Averaged Spectrum Windows the overload indications are shown to the right of the spectrum display. The latched overload indicates that an overload occurred in one or more of the frequency bands during measurement. In the Averaged Spectrum Window the latched overload may have occurred in any of the scans, if a number of scans were selected.

Note: Overloads in the spectrum windows are only detected during the measurement periods (T_{Dwell}), i.e., no overloads are detected during the filter and detector settling periods.

4.1.6 Pausing/Interrupting a Measurement

In the Working Spectrum and Broadband Measurement Windows you can use the ⅋ key to pause/continue an ongoing measurement. When resuming a measurement after pausing Mediator, the measurement is continued without resetting data. Pressing this key after a measurement is finished performs a reset and starts a new measurement.

If the Working Spectrum Window is displayed and you press the ⅋ key during a measurement, the Back Erase mode is activated (see Erasing Bad Data below).

4.1.7 Instantaneous Value

A separate column on the right hand side of the spectrum display shows the instantaneous value (L_{XYInst}) of the RMS level and is updated five times per second. The associated frequency weighting is shown in the lower right-hand corner of the display.

4.2 Erasing Bad Data

The back-erase function allows you to delete any number of frequency bands in the current scan. This is particularly useful for deleting a non-typical noise occurrence during a measurement.

1. Use the key to display the Working Spectrum Window during a measurement.

2. Press the Pause/Continue key. The `Time Left` line is replaced with a `<Back Erase>` soft key.

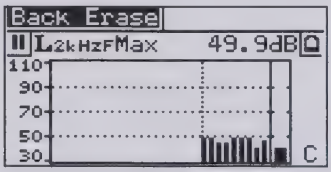

Fig.4.3 The Back Erase function

3. Use the ◄ ► cursor keys to move the spectrum cursor to the frequency band to which you want to delete the frequency bands.

4. Press the `<Back Erase>` softkey to back-erase. All the frequency bands to the left of the cursor, and the frequency band at which the cursor points, are deleted. You can delete more frequency bands by moving the cursor to the right and pressing `<Back Erase>` again.

You can continue the measurement by pressing the ⅛ Pause/Continue key. The `Time Left` field is updated to show the actual remaining measurement time.

Note: If you do not back-erase any frequency bands, the measurement will continue from the frequency band where it was paused.

4.3 Setting a Measurement to Start Automatically

Mediator can manage up to four auto starts. Auto Starts are shared among the application modules that support them. Each Auto Start has a number (1 through 4) and is set to start a specific application at a specified time (up to one month ahead) using a specified set-up. See also section 3.1.5 in the Basic User Manual.

From a specific software module, in this case Frequency Analysis Software BZ 7123, all four Auto Starts can be seen and selected, but you can only set up an Auto Start for the currently running application module. If you want another application module to start, the Auto Start must be set from that module.

To set up an Auto Start:

1. Select `Auto Start` from the Measurement Set-up menu.

   If no Auto Start is set up, for example for Auto Start no. 1, the display appears as:

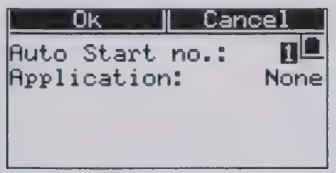

Fig.4.4 The basic Auto Start Window

2. Use the ◄ ► cursor keys to select one of the four Auto Starts and press <Ok>.

   If the Auto Start is active, the display will show the associated application module as well as the set-up number and the start time.

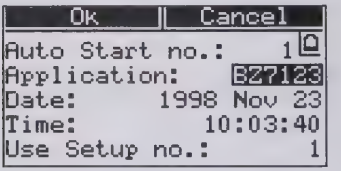

Fig. 4.5 Auto Start set-up

   Use the ▲ ▼ cursor keys to select the Application field, and use the ◄ ► cursor keys to select None or BZ7123. None means that the Auto Start is not active (if previously set, the set-up parameters will be deleted if you press Ok). If the Auto Start is already activated by another application module (for example BZ7124), the number of this application module is also among the choices. The display will appear similar to Fig. 4.5.

3. Set up the Date, Time and Use Setup no. fields as required. The date and time can be set to one month ahead.

4. Press Ok to activate the Auto Start.

When switching Mediator off, the message shown in Fig. 4.6 is displayed.

Notes: An Auto Start only takes effect if Mediator is switched off at the time the Auto Start is supposed to run. If Mediator is already switched on, the Auto Start is cancelled.

Mediator keeps measuring until the selected number of scans are finished or until manually stopped.

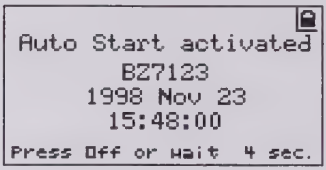

Fig. 4.6 Confirmation of an Auto Start when switching Mediator off

Mediator switches on approximately 30 s before the set time for an Auto Start. This allows Mediator to settle and start measuring at exactly the set time.

Chapter 5

Data Handling

5.1 Data Storage 5–2

Saved Data 5–2
Set-up Data 5–2
Measurement Data 5–2

5.2 Store Files 5–3

5.3 File Manager 5–4

5.4 Printing Data 5–4

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Switching Between the Recall Windows 5–5
Switching Between Recalled Files 5–5
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5.1 Data Storage

5.1.1 Saved Data

A measurement data file contains both overall measurement data and spectrum measurement results. It consists of a group of set-up data and a group of associated measurement data. The set-up data are:

- Serial number for Mediator unit
- Measurement set-up
- Calibration data

Measurement data are:

- Overall results
- Broadband measurement results
- Spectrum measurement results ($^1/_3$- or $^1/_1$-octave)

5.1.2 Set-up Data

Measurement Set-up

All measurement set-up parameters that were used for the measurement.

Calibration Set-up

- Microphone type
- Sensitivity
- Calibration date

5.1.3 Measurement Data

Overall Results

- Start Date
- Start Time

- Elapsed Time
- Overload
- Underrange
- Scan No.

Broadband Measurement Results

- L_{eq}, L_{Max}, L_{Min}

Spectrum Measurement Results

The following data are always saved for each frequency in the $^1/_3$- or $^1/_1$-octave frequency bands. Only the bands within the measured frequency range are saved:

- L_{eq}, L_{Max}, L_{Min}
- Marks (Overload, Underrange)

In printouts overloads are marked as `O` and underrange as `U`. If an underrange occurs in a frequency band, the associated value field appears as: ---.-

If the first scan is saved without completing all frequency bands, the value fields for the missing bands appear as: `N.A.`

5.2 Store Files

Automatically Saved Files

If the `Auto Save` function in the `Meas. Control` Window is switched on, measurements are stored automatically with consecutive numbers.

How to Store the Current Measurement Manually

1. Press the Data Files key to display the Data Files menu.

2. Press the Data Files key, the <Select> softkey or the ► cursor key or to store the measurement with

the displayed file name. "Saving File ..." is displayed while saving takes place.

Single Scan

If a single scan is selected you can store the frequency bands that have been completed:

1. Press the ⅋ Pause/Continue key to pause the measurement.

2. Store the measurement as described above.

Multiple Scans

If more than one scan is selected, only the complete scans are stored. The stored scan is identical to the scan shown in the Averaged Spectrum Window.

5.3 File Manager

The File Manager is used to give an overview of the data files in the memory and has options for recalling, printing and deleting these files. The Disk Summary option shows the memory status. Refer to the Basic User Manual for information about how to use the File Manager

5.4 Printing Data

Printing is similar to the Basic module, the main difference is that the Print Options menu does not exist, i.e., all set-up and measurement parameters are printed.

You can print the current measurement or you can print a single or a number of recalled files via the File Manager or by using the <Print> softkey.

5.5 Displaying Stored Files

If a stored file has been recalled from the `File Manager` the data is displayed in two recall windows as illustrated in Fig. 5.1

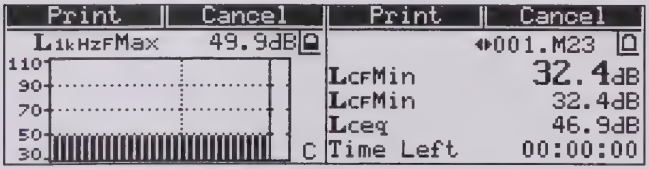

Fig. 5.1 The Recall Average Spectrum and the Recall Broadband Measurement Windows (separate windows)

Except for the instantaneous parameters and overload indication these windows are similar to the Average Spectrum Window and the Broadband Measurement Window.

5.5.1 Switching Between the Recall Windows

Use the ▲ key to switch between the Recall Average Spectrum and Recall Broadband Measurement Windows.

Note: Both ▼ ▲ keys switch between the windows when they reach the top or bottom of the current window.

Use the Meas. Results key to return to the measurement window which was active when you recalled the stored files.

5.5.2 Switching Between Recalled Files

Use the Data Files key to step through the files, if more than one file has been selected in the `File Manager`.

If the cursor is positioned in the `Print/Cancel` fields in the Recall Broadband Window, you can also use the ◄ ► keys to step down/up through the file list.

5.5.3 Selecting Parameters and Frequency Bands

Parameters

In the Broadband Measurement Windows you can use the ▼ ▲ and ◄ ► keys to select one of the four parameter lines and change the parameters, exactly as in the Broadband Measurement Window

Frequency Bands

In the Recall Average Spectrum Window you can use the ◄ ► keys to step the cursor through the frequency bands when the `Print/Cancel` fields are highlighted.

If you select the Parameter Field, you can use the ◄ ► keys to display the L_{eq}, L_{Ymin} or L_{Ymax} spectra as required.

Chapter 6

Specifications

6.1 Specifications for Frequency Analysis Software (BZ 7123)

Note: These Specifications are additional to the Specifications described in the Basic User Manual

System Requirements:

The 1/1-octave and 1/3-octave filter set must be installed in Mediator to support Frequency Analysis Software BZ 7123 (i.e. Type 2238–A–F). A hardware upgrade (installation of filter set 2238 MUF) can be made at a Brüel & Kjær service centre.

Measurements:

The available measurement parameters are listed in the table below. Detector 1 measures 1/1- or 1/3-octave band data while Detector 2 measures broadband data. You can select A, C and L frequency weighting for broadband data and F or S time weightings for both detectors

Symbol Key (for measurement parameters):

X: Frequency weighting A, C or L
Y: Time weighting F or S.

Detector 1 RMS	Detector 2 RMS
Spectrum	**Broadband**
Stored	
L_{eq}	L_{Xeq}
L_{YMax}	L_{XYMax}
L_{YMin}	L_{XYMin}
Overload%	
Underrange%	
Start Date	
Start Time	
Elapsed Time	
Scan No.	
Instantaneous (display only)	
–	L_{XYp}
–	L_{XYinst}
Time Left	
Time	

Measuring Ranges:

Linear Operation Range: 80 dB, adjustable to give full-scale readings in 10 dB steps over the range: 80 – 140 dB
Upper Limit (RMS) for Crest Factor = 10: 17 dB below full scale reading

Detectors:

Simultaneous detection of spectrum and broadband parameters
Spectrum: 1/1-octave and 1/3-octave band filters with two exponential time weightings (F or S) and a linear averaging detector
Broadband: Two exponential time weightings (F or S) and a linear averaging detector. Selectable frequency weighting A, C or Lin
Overload Detector: Monitors all the frequency weighted channels

Auto Start:

The Mediator supports four Auto Starts which allow set-up of measurement start times up to a month in advance

Aux 1 Output:

Connector: 2-pin LEMO
AC Output Signal: Range-adjusted AC output, with the frequency band currently selected on detector 1. Short-circuit protected
Output: 1 V RMS corresponding to full-scale indication
Max. Load: 10 kΩ || 1 nF
Output Impedance: Typically 100 Ω

Aux 2 Output:

Connector: 2-pin LEMO. Can be used as a DC output, a trigger input or a trigger output.

DC Output:

Output Signal: DC version of signal on RMS detector 1 (Fast, Inst). Delayed 0.8 s. Short-circuit protected
Output: 0 to 4.0 V DC, (50 mV/dB)
Update Rate: 160 times per second
Max. Load: 10 kΩ || 1 nF
Output Impedance: Typically 100 Ω

Trigger Input:

Voltage Range: 0 to 4 V
Trigger Level: 2 V on positive edge

Trigger Output:
Trigger Output: Pause: 0 V, Measuring: 4 V

Settling Time

From Power On: <10 s

6.2 Additional Specifications for Filter Set

Standards:

Conforms with the following:

- EN 61260/IEC 1260 (1995) Octave and 1/3-octave Bands Class 1
- ANSI S1.11 – 1986 Octave and 1/3-octave Bands, Order 3, Type 1-D. Optional Range

Octave and 1/3-octave Band Filters:

Frequency Rating System: Base 10
Reference Attenuation: 0 dB
Linear Operating Range: As Indicator range
Nominal Octave Band Centre Frequencies: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz
Nominal 1/3-octave Band Centre Frequencies: 20 Hz, 25 Hz, 31.5 Hz, 40 Hz, 50 Hz, 63 Hz, 80 Hz, 100 Hz, 125 Hz, 160 Hz, 200 Hz, 250 Hz, 315 Hz, 400 Hz, 500 Hz, 630 Hz, 800 Hz, 1 kHz, 1.25 kHz, 1.6 kHz, 2 kHz, 2.5 kHz, 3.15 kHz, 4 kHz, 5 kHz, 6.3 kHz, 8 kHz, 10 kHz, 12.5 kHz

CE	CE-mark indicates compliance with: EMC Directive.
EMC Emission	**EN 50081–1:** Generic emission standard. Part 1: Residential, commercial and light industry. **EN 50081–2:** Generic emission standard. Part 2: Industrial environment. **CISPR 22:** Radio disturbance characteristics of information technology equipment. Class B Limits. **FCC Rules, Part 15:** Complies with the limits for a Class B digital device.
EMC Immunity	**EN 50082–1:** Generic immunity standard. Part 1: Residential, commercial and light industry. RF immunity implies that sound level indications of 50 dB or greater will be affected by no more than 0.5 dB. **EN 50082–2:** Generic immunity standard. Part 2: Industrial environment. RF immunity implies that sound level indications of 65 dB or greater will be affected by no more than 0.5 dB.
	These levels of immunity are 9 dB better than required by IEC 1672.
Note: The above conformance is guaranteed only when using the included/optional accessories.	

Brüel & Kjær reserves the right to change specifications and accessories without notice

Chapter 7

Appendix

7.1 List of Default Parameters ..... 7 – 2

7.2 Messages ..... 7 – 2

7.3 Warnings ..... 7 – 4

7.1 List of Default Parameters

Note: These default parameters are in addition to those described in the Basic User Manual.

Menu	Set-up Parameter	Default Value
Weightings	Bandwidth	1/3 Octave
	Limits (1/3 Octave)	20 – 12.5 kHz
	Limits (1/1 Octave)	31.5 – 8 kHz
	Broadband Wgt.	C
	Time Weighting	F
Meas. Control	No. of Scans	1
	Dwell Time	Optimized
	Tolerance	0.5 dB
	(Fixed)	00:01
	Auto Save	Off
Input/Output	Aux 1	AC Output (fixed)
	Aux 2	DC Output

7.2 General Messages

The following messages may appear when using the Frequency Analysis module.

Message	Occurs	Solution
Measurement will be reset Continue	When one or more scans remain in the Averaged Spectrum and you try to: 1: Press the reset key 2: Change the range setting 3: Change one of the weighting parameters 4: Change the Dwell Time or Tolerance values in the Meas. Control Window 5: Change the Correction Filter settings	Press `Ok` to change the set-up, the measurement will be reset. Press `Cancel` to skip without changing
Spectrum incomplete Save anyway?	When a pause is made during the first scan and you try to save the measurement	Press `Ok` to save the spectrum and return to the Measurement Window. Press `Cancel` to go to the Data Files Window without saving the measurement. The measurement can be continued
Measurement incomplete Save completed scans?	When a pause is made during the second or later scans and you try to save the measurement	Press `Ok` to save the averaged spectrum and return to the Measurement Window. Press `Cancel` to return to the Data Files Window without saving the measurement. The measurement can be continued

7.3 Error Messages

The following warning may appear when using the Frequency Analysis module.

No filter set Installed	When you activate the Frequency Analysis module without having the $^1/_1$-octave and $^1/_3$-octave filter set installed	If you press Ok the program will display the Measurement Window and function normally, however, you cannot make any $^1/_1$-octave or $^1/_3$-octave measurements

Chapter 8

Interface

8.1 Controlling Mediator via the Serial Interface..... 8–2

Commands and Queries 8–2
Average? 8–2
PArameter? 8–3
SEtup 8–5
Working? 8–9

8.1 Controlling Mediator via the Serial Interface

8.1.1 Commands and Queries

The command and query messages available with the Frequency module are listed in Table 8.1. The interface jobs that are specific for the frequency module are explained in the following.

Message	Command	Query	Message	Command	Query
Average		•	PAUse	•	
Continue	•		RAnge	•	•
Error		•	REset	•	
File		•	SEtup	•	•
Header	•	•	STatus		•
IDentify		•	SYstem	•	•
Key	•		Version		•
PArameter		•	Working		•

Table 8.1 Command and query message overview

8.1.2 Average?

The **Average?** query is used for checking the average measurement values over all scans for all frequency bands. The syntax for the query **Average?** and the response returned by Mediator appears in Fig. 8.1.

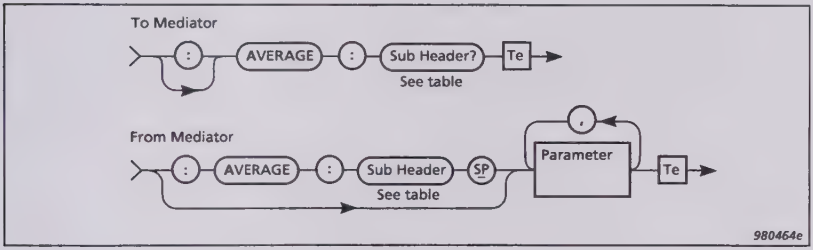

Fig. 8.1 Syntax for the Average? query and Mediator response

Sub Header
LEq?
LMAx?
LMIn?

Table 8.2 Average? queries

Example (reading the average L_{eq} value):

Query from controller:

`Average:LEq?`

From Mediator (values in dB):

`:AVERAGE:LEQ 48.4,46.6,...,52.5,51.3`

8.1.3 PArameter?

The **PA**rameter**?** query is used for checking the selected measurement parameters. The syntax for the query **PA**rameter**?** and the response returned by Mediator appears in Fig. 8.2.

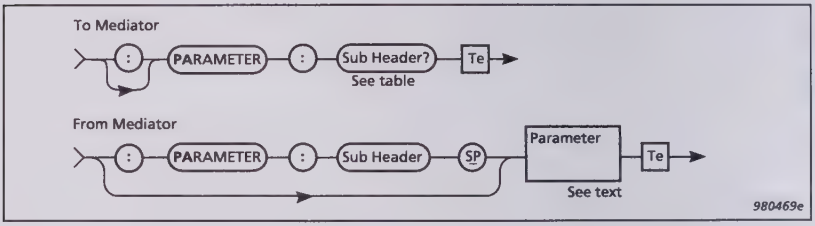

*Fig.8.2 Syntax for the **PA**rameter? query and Mediator response*

Sub Header
ELapsed
Inst
LEq
LMAx
LMIn
LP
Overload
Scan_Number
Start_Time
Start_Date
Time_Left
Underrange

*Table 8.3 Sub-header and parameter settings for the **PA**rameter? query*

Example (reading the broadband measured L_{eq} value):

Query from controller:

```
PArameter:LEq?
```

From Mediator (value in dB):

```
:PARAMETER:LEQ 52.6
```

8.1.4 SEtup

The **SE**tup commands are used for setting up most of the measurement parameters in the Measurement Setting menu.

SEtup Commands

The **SE**tup commands (except for Auto_Start) use the syntax illustrated in Fig. 8.3.

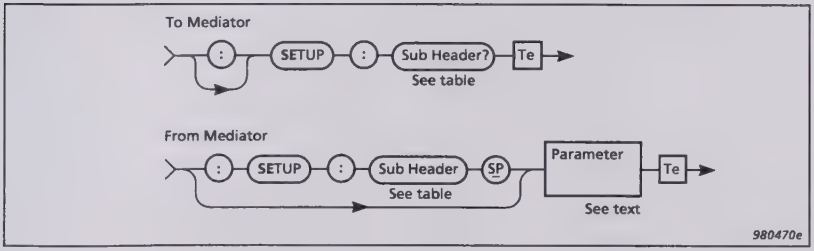

*Fig. 8.3 Syntax for the **SE**tup command*

Sub Header	Parameter Setting			Comments
	No.	Setting	Type	
Auto_**S**ave	–	**OF**f **ON**	Char	Switches autosave on of off
Aux_**2**	–	**O**ut Trigger_**I**n Trigger_**O**ut	Char	Sets **Aux 2** to DC Output Sets **Aux 2** to Trigger Input Sets **Aux 2** to Trigger Output
Bandwidth	–	**O**ctave_**3** **O**ctave_**1**	Char	Set the bandwidth to 1/3- or 1/1-octave
Broadband _**W**eighting	–	**A** **C** **L**in	Char	Sets A-, C- or Linear weighting
Dwell_**T**ime	–	**O**ptimized **F**ixed	Char	Sets the measurement time for each frequency band

*Table 8.4 Sub-header and parameter settings for the **SE**tup command*

Sub Header	Parameter Setting			Comments
	No.	Setting	Type	
Limits	1	**F20, F25, F31_5, F40, F50, F63, F80, F100, F125, F160, F200, F250, F315, F400, F500, F630, F800, F1K, F1K25, F1K6, F2K, F2K5, F3K15, F4K, F5K, F6K3, F8K, F10K, F12K5**	Char	Sets the Upper Limit E.g., F3K15 = 3.15 kHz
	2	**F20, F25, F31_5, F40, F50, F63, F80, F100, F125, F160, F200, F250, F315, F400, F500, F630, F800, F1K, F1K25, F1K6, F2K, F2K5, F3K15, F4K, F5K, F6K3, F8K, F10K, F12K5**	Char	Sets the Lower Limit E.g., F31_5 = 31.5 Hz To set the limits send, for example, the command with the upper limit first: :SE:L F3K15,F20
No_Of_Scans	1	**1 ... 99**	NR1	Sets the number of scans
Random_Frontal	–	Random Frontal	Char	Sets Random or Frontal frequency correction
Recall	1	**0 ... 4**	NR1	Recall measurement set-up 0 to 4 (0 is default set-up)
SAve	1	**1 ... 4**	NR1	Saves measurement set-up in memory 1 to 4

*Table 8.4 (cont.) Sub-header and parameter settings for the **SEtup** command*

Sub Header	Parameter Setting			Comments
	No.	Setting	Type	
SEquence	–	**OF**f **ON**	Char	Switches the Auto Start sequence On or Off
TIme	1	**0 ... 60**	NR1	Minutes
	2	**0 ... 59**	NR1	Seconds Sets the measurement time for each frequency band if **D**well_**T**ime is **F**ixed
Time_**W**eighting	–	**F**ast **S**low	Char	Sets the time weighting to Fast or Slow
TOlerance	–	**T_0_25** **T_0_50** **T_1**	Char	0.25, 0.5 or 1 dB tolerance Used if **D**well_**T**ime is **O**ptimized
Wind_**S**creen	–	**OF**f **ON**	Char	Switches the windscreen frequency correction On or Off

*Table 8.4 (cont.) Sub-header and parameter settings for the **SE**tup command*

SEtup? Queries

The syntax for the query **SE**tup**?** and the response returned by Mediator appears in Fig. 8.4.

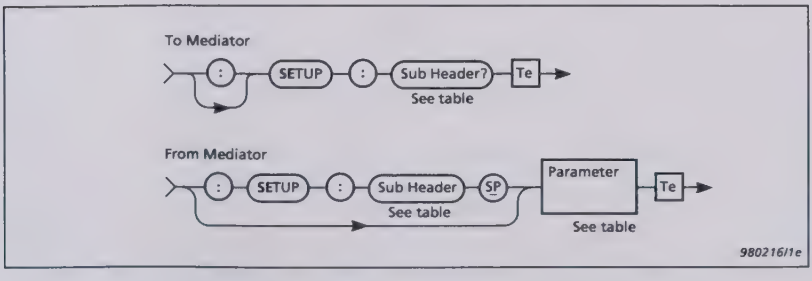

*Fig. 8.4 Syntax for the **SE**tup? query and Mediator response*

Sub Header
Auto_Start_1? Auto_Start_2? Auto_Start_3? Auto_Start_4?
Auto_Save?
Aux_1?
Aux_2?
Bandwidth?
Broadband_Weighting?
Dwell_Time?
Limits?
No_Of_Scans?
Random_Frontal?
SEquence?
TIme?
Time_Weighting?
TOlerance?
Wind_Screen?

Table 8.5 SEtup? queries

Example (checking the Tolerance set to 0.5 dB):

Query from controller:

```
SEtup:TOlerance?
```

From Mediator:

```
:SETUP:TOLERANCE  T_0_5
```

8.1.5 Working?

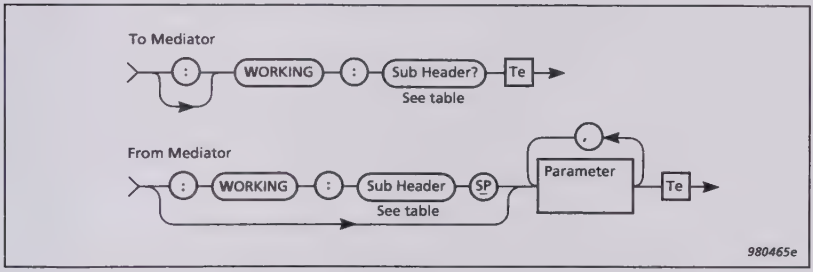

Fig. 8.5 Syntax for the Working? query and Mediator response

The **Working?** query is used for checking the working measurement values for the current scan in all frequency bands. The syntax for the query **Working?** and the response returned by Mediator appears in Fig. 8.5.

Sub Header
LEq?
LMAx?
LMIn?

Table 8.6 Working? queries

Example (reading the working L_{eq} value):

Query from controller:

`Working:LEq?`

From Mediator (values in dB):

`:WORKING:LEQ 48.8,45.9,...,51.6,52.0`

Chapter 9

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